Quarterly Status Report No. 13

1 March to 31 May 1966

EXTREME ULTRAVIOLET EXPERIMENTS IN CONJUNCTION WITH GSFC "GEO-PROBES"

NASA - DEFENSE Purchase Request R-92

Submitted to:

Office of Grants and Research Contracts

Code SC

National Aeronautics and Space Administration

Washington 25, D. C.

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Under NASA-Defense Purchase Request R-92, AFCRL will conduct six Aerobee rocket flights of instrumentation to measure solar extreme ultraviolet radiation as a function of altitude and wavelength. These flights are to be performed in conjunction with GSFC experiments in ion and electron characteristics ("geoprobe" or similar instrumentation), in a study of the upper atmosphere and the influence of radiation from the sun.

All six EUV monochromators have been fabricated. The first two instruments have been calibrated in the laboratory and integrated with the biaxial solar pointing controls and telemetry systems. Designated Aerobees 4.99DS and 4.100DS, to be flown with NASA Argo D-4 8.25 GA-GI, the rocket experiments were finally scheduled for flight on 23 and 24 February 1966 from Wallops Island, Virginia.

The primary objectives of the geoprobe payload (Argo D-4) were the measurement of the vertical distribution of parameters of the neutral atmosphere and the ionosphere. Specifically, these were simultaneous observations of electron density, neutral gas density, electron temperature, neutral gas temperature, ion composition and neutral gas composition.

The Aerobee rocket, with the AFCRL monochromator as primary payload and a retarding potential analyzer, was to be launched immediately prior to the geoprobe to obtain data on incoming solar radiation to which the above parameters are related.

After several days of delays due to adverse weather conditions and geoprobe instrumentation problems, the combined experiments were launched on 2 March 1966. Aerobee 4.99DS was launched successfully at 1755 Z. Proper separation of the nose cone and accurate pointing of the instruments at the sun were accomplished. Operation of the EUV monochromator was successful throughout the 230 second total data acquisition period, both on ascent and descent. The retarding potential analyzer experiment was also successful. The quality of the data indicates that the experiment was a success.

Argo D-4 8.25 GA-GI was launched at 1760 Z while the Aerobee was airborne. The geoprobe payload was also successful, so that the overall

combined experiment was a success. Data from these experiments is currently being analyzed, and will be published at a later date.

The back-up Aerobee, 4.100 DS, was launched the following day, 3 March 1966, at 2154 Z. The payload was identical in all respects to 4.99 DS, and was launched in an attempt to study the short-term variation of solar extreme ultraviolet radiation. Proper separation of the nose cone and initial acquisition of pointing at the sun were accomplished. Operation of the EUV monochromator and the retarding potential analyzer was satisfactory.

However, the rocket performance of 4.100 DS was unsatisfactory. Although the vehicle exceeded its predicted peak altitude, it encountered pitch-roll lock-in and progressed into a large coning motion after burnout, which compromised the pointing ability of the pointing control. Due to the coning of the rocket vehicle, accurate solar pointing and consequent data acquisition was possible only approximately 60% of the time. In addition, observed EUV intensities were lower than expected, indicating a possible malfunction or damage to the instrument during flight. In effect, the experiment (4.99 DS) can be considered as only partially successful.

The Aerobee Vehicles Section at GSFC is extremely concerned about the erratic behavior of the Aerobee 150A (4.100 DS) and is taking definitive steps to avoid a similar occurrence on the remaining four rocket flights in this series, namely 4.101 DS through 4.104 DS. A yo-yo despin unit will be incorporated into the rocket to permit a higher spin rate during the powered portion of the flight to eliminate pitch-roll lock-in, and subsequent despinning of the vehicle to allow proper operation of the solar pointing control.

The next experiment to be flown in this series will be 4.101 DS, currently scheduled for 27 August 1966 at Wallops Island, Va. This will be performed in conjunction with flights of the GSFC "thermosphere probe" on Nike-Apache rockets 14.285 UM and 14.286 UM, all launches to be timed to concur with the passage of the AEB satellite (Explorer 32).

A planning meeting for these combined experiments will be held at GSFC on 22 June 1966.